PROFILE

University Exam No. :

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Subject: Physical chemistry.
Year: 2022-2023
Semester: Second.
Class: M.Sc (chemistry)
Roll No.: 01
Academic Year: 2022-2023
Branch: Department of Science
Professor in Charge:
Department: Science
University: Mumbai

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Sr. No	Mathematical Function	Range.
1.	$f(x) = 1$	$0^\circ C - 360^\circ C$
2.	$f(x) = \cos\theta$	$0^\circ C - 360^\circ C$
3.	$f(x) = 3\cos^2\theta - 1$	$0^\circ C - 360^\circ C$

* Observation Table -

1) For is arbitaly, $f(x) = 1$

θ in °C	~~for~~ $f(\theta) = 1$
0	f(0) = 1
10	f(10) = 1
20	f(20) = 1
30	f(30) = 1
40	f(40) = 1
50	f(50) = 1
60	f(60) = 1
70	f(70) = 1
80	f(80) = 1
90	f(90) = 1
100	f(100) = 1
110	f(110) = 1
120	f(120) = 1
130	f(130) = 1
140	f(140) = 1
150	f(150) = 1
160	f(160) = 1
170	f(170) = 1
180	f(180) = 1

θ in °C	$f(\theta) = 1$
190	f(190) = 1
200	f(200) = 1
210	f(210) = 1
220	f(220) = 1
230	f(230) = 1
240	f(240) = 1
250	f(250) = 1
260	f(260) = 1
270	f(270) = 1
280	f(280) = 1
290	f(290) = 1
300	f(300) = 1
310	f(310) = 1
320	f(320) = 1
330	f(330) = 1
340	f(340) = 1
350	f(350) = 1
360	f(360) = 1
~~370~~	
~~380~~	

EXPERIMENT: No. 1

Polar plot of atomic orbitals.

Quantam Chemistry

Date / /
Page 1

Aim - To draw plots of atomic orbitals such as 1s, $2P_z$, $3d_{z^2}$ by using angular part of hydrogan atom wave function.

Theory -

$$\psi_{1s} = \frac{1}{\sqrt{\pi}} \frac{z^{3/2}}{a} e^{-zr/a} \text{ for } H_2 = 2$$

$$\psi_{3d_{z^2}} = \frac{1}{8(8\pi)^{1/2}} \frac{z^{7/2}}{a} r^2 - e^{-zr/3a} (3\cos\theta^2 - 1)$$

$$\psi_{2P_z} = \frac{1}{4(2\pi)^{1/2}} \frac{z^{6/2}}{a} . r - e^{-zr/3a} (\cos\theta^2 +)$$

z = 1 for hydrogen atom.

$$\text{for } \psi_3, \psi_{1s} = \frac{1}{\sqrt{\pi}} - \frac{1}{a}^{3/2} . e^{-r/a}$$

(1) Tabulate the value for mathematical wave fuction A & B in the range of 0°c to 360°c

(2) Select the appromate step size value of angular interval within given range of function.

(3) Find the value of every step one plant the graph on spherical polar graph paper. from the nature of graph identify the atomic orbital.

Teacher's Sign:

2) For 2Pz orbital, $f(x) = \cos\theta$

θ in °c	$f(\theta) = \cos\theta$
0	1.00
10	0.98
20	0.93
30	0.86
40	0.76
50	0.69
60	~~0.50~~ 0.50
70	0.34
80	0.17
90	0.0
100	-0.17
110	-0.34
120	-0.50
130	-0.64
140	-0.76
150	-0.86
160	-0.93
170	-0.98
180	-1.00

θ in °c	$f(\theta) = \cos\theta$
190	-0.98
200	-0.93
210	-0.86
220	-0.76
230	-0.64
240	-0.50
250	-0.34
260	-0.17
270	0.0
280	0.17
290	0.34
300	0.50
310	0.64
320	0.76
330	0.86
340	0.93
350	0.98
360	1.00
~~370~~	

3) For $3d_{z^2}$ orbital $f(x) = 3\cos^2\theta = 1$

θ in °C	$f(\theta)=\cos\theta$	$f(\theta)=\cos^2\theta$	$3\cos^2\theta$	$3\cos^2\theta - 1$
0	1	1	3	2
10	0.98	0.96	2.88	1.88
20	0.93	0.86	2.58	1.98
30	0.86	0.73	2.21	1.21
40	0.76	0.57	1.73	0.73
50	0.64	0.40	1.20	0.20
60	0.50	0.25	0.75	-0.25
70	0.34	0.11	0.39	-0.66
80	0.17	0.02	0.08	-0.91
90	0.00	0.00	0.00	-1.00
100	-0.17	0.~~07~~ 0.2	0.08	-0.92
110	-0.34	0.~~25~~ 11	0.39	-0.76
120	-0.50	0.~~40~~ 25	0.75	-0.25
130	-0.64	0.~~57~~ 40	1.20	-0.20
140	-0.76	0.~~73~~ 57	1.73	-0.73
150	-0.86	0.~~86~~ 73	2.21	1.21
160	-0.93	0.~~93~~ 86	2.58	1.58
170	-0.98	0.96	2.88	1.58
180	-1.00	1.00	3.00	1.88
190	-0.98	0.96	2.88	1.88
200	-0.93	0.86	2.58	1.58
210	-0.86	0.73	2.21	1.21
220	-0.76	0.57	1.73	1.73
230	-0.64	0.46	1.20	1.20
240	-0.50	0.25	0.75	-0.25
250	-0.34	0.11	0.39	-0.76
260	-0.17	0.02	0.08	-0.92
270	-0.00	0.00	0.00	-1.00
280	0.17	0.02	0.08	-0.92
	0.34	0.11	0.33	-0.67

EXPERIMENT: No.

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θ in °c	f(θ) = cos θ	f(θ) = cos²θ	3cos²θ	3cos²θ − 1
300	0.50	0.25	0.75	−0.25
310	0.64	0.40	0.20	0.20
320	0.76	0.57	1.73	−0.73
330	0.86	0.73	2.21	1.21
340	0.93	0.86	2.58	1.58
350	0.98	0.96	2.88	1.88
360	1.00	1.00	3.00	2.00

Result –

Sr. No	Mathamatical function	Name of orbital.
1.	$f(\theta) = 1$	1s
2.	$f(\theta) = \cos\theta$	$2p_z$
3.	$f(\theta) = 3\cos^2\theta - 1$	$3d_{z^2}$

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01/06/23

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Teacher's Sign:

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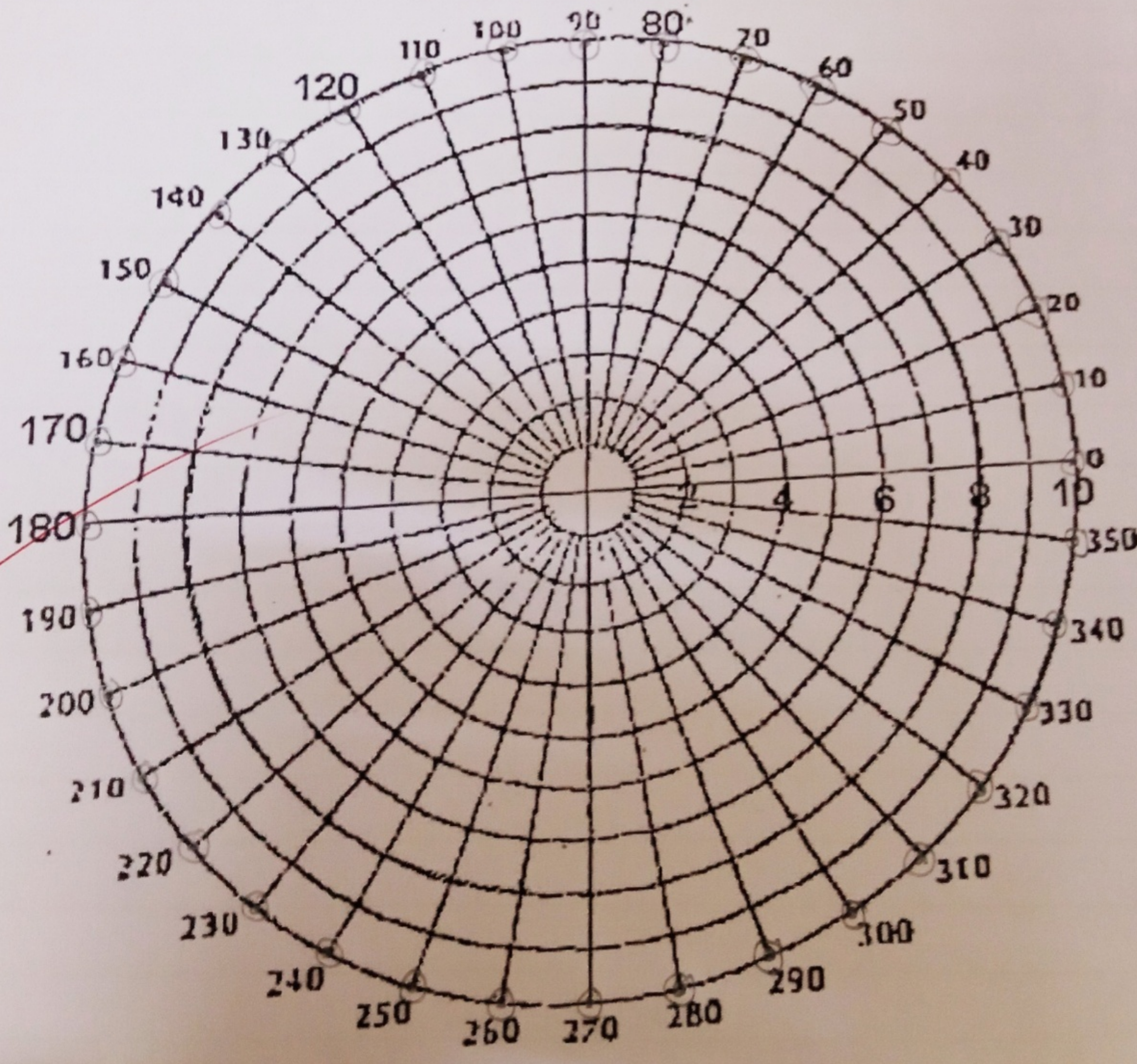
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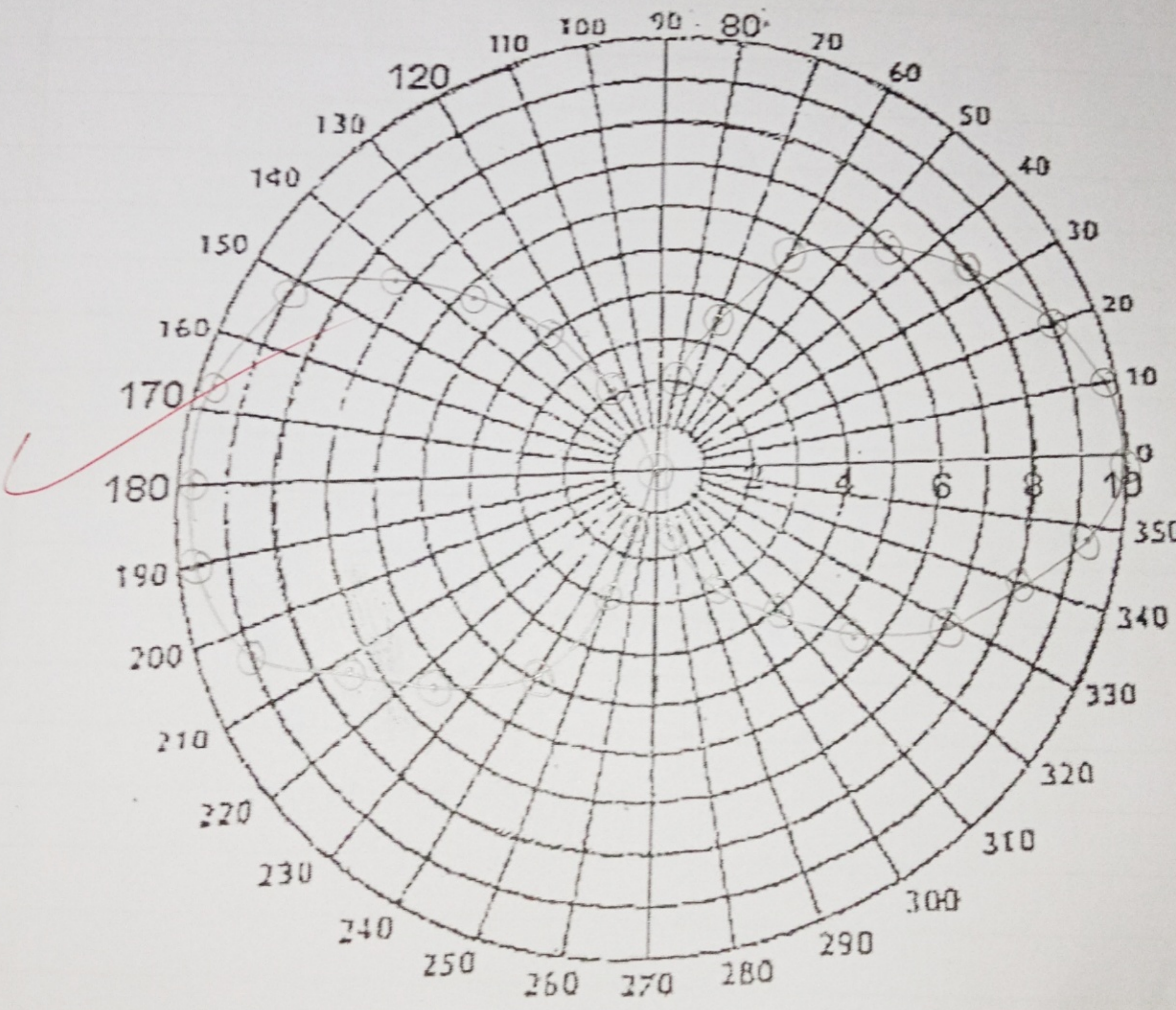
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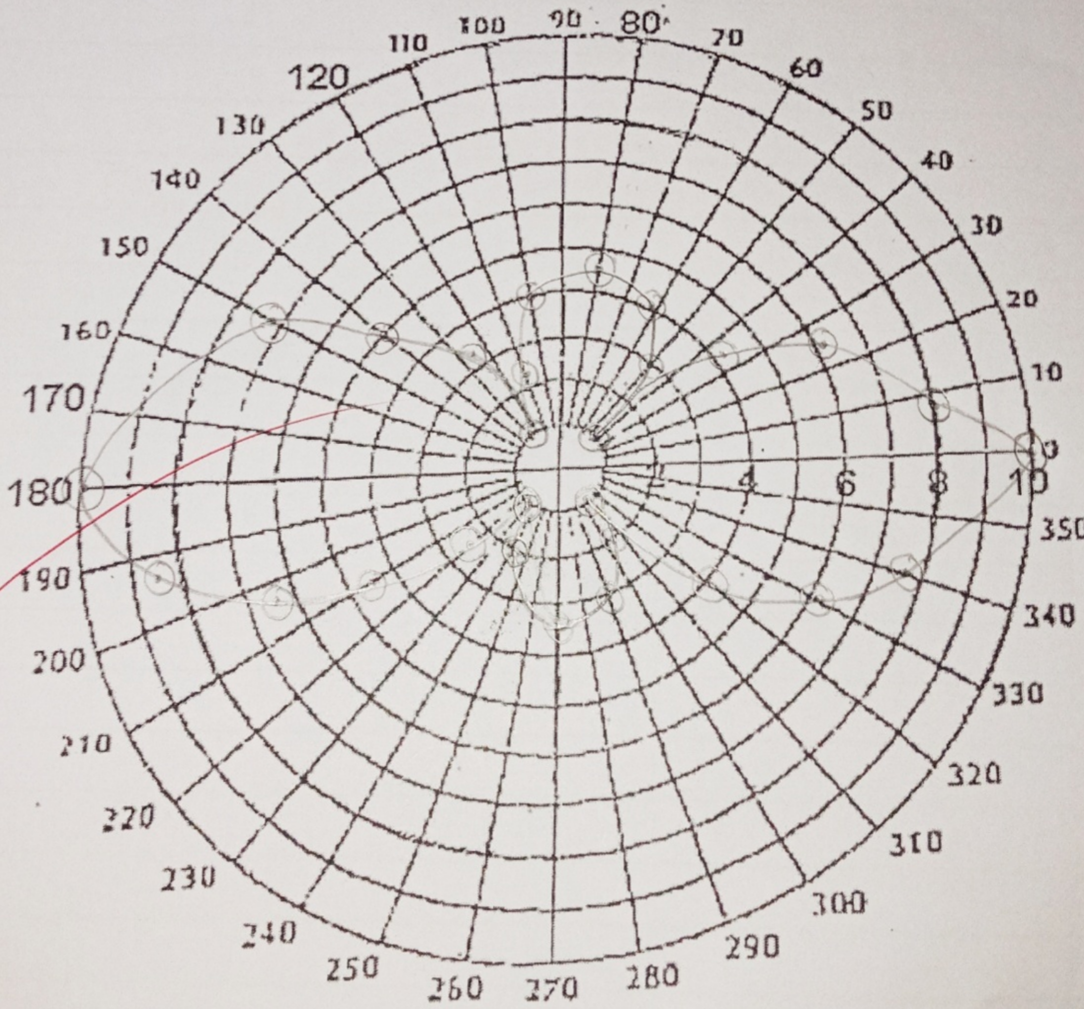
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SPHERICAL POLAR GRAPH PAPER

(M.Sc – SEM –II)

EXAM NO. --------------------------



Teacher's Sign:

Phase diagram of water-
Chloroform acetic acid.

EXPERIMENT No. 2 Phase Rule

Date / /
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Aim - To determine the phase diagram for the sew system water chlorofrom - acceticacid / water acetic acid.

Theory - on mixing water one folune we get too conjugate solution of diffrent composition - when acetic acid is added in this system, the matual solubility of water and tolune increases and a point is arched at which the mixture becomes homogenous. The quantity mixture depend upon the ealatine. proporation of water and tolune. thus of the third compount is soluble in the ether two compounds. the solublity of the two componel is increased, when the third component is added to a mixture of the other two component.

If water is added to a mixture of actic acid and tolune, a hetrogeny. mixture (two layers are fromed) The quantity of water which is to be added to obtain a hetrogeny mixture depends upon the caltive proportion of acetic acid and Tolune, such of the third componet. is sutable in only one of the other to compounds. the solublity of the compound is dersed when the third compound is added to mixture of the other two componerds.

Requiremerds. - micropipette. microburette. 250 cm^3 of stopperd. bottle, pure tolune. glacial acetic. acid. d.w, etc.

Teacher's Sign:________

* Observation –

① Solution in burette – Distilled water.

② Solution in Stappered bottles – Chloroform + Acetic acid

③ End point – Colourless to turbidity

* Observation Table –

Volume Taken (cm^3)		Weight taken (g)		Titrate value (cm^3)	Total weight of mix (g)	% Composition of final mixture by weight		
$CHCl_3$	CH_3COOH	$CHCl_3$	CH_3COOH			$CHCl_3$	CH_3COOH	H_2O
3.0	12.0	4.43	12.6	6.5	23.53	18.82	53.54	27.62
5.0	10.0	7.39	10.5	5	22.89	32.28	45.87	21.84
6.0	9.0	8.86	9.45	4	22.31	39.71	42.35	17.92
7.0	8.0	10.39	8.4	3.5	22.24	46.49	37.76	15.53
8.0	7.0	11.82	7.35	3.2	22.37	32.83	32.76	14.30
9.0	6.0	13.30	6.3	2.8	22.4	59.37	28.12	12.5
10.0	5.0	14.78	5.25	2.5	22.53	65.60	23.30	11.09
11.0	4.0	16.25	4.2	1.5	21.95	74.03	19.13	6.83
12.0	3.0	17.73	3.15	1.2	22.08	~~80.22~~ 80.29	14.26	5.43

EXPERIMENT: No.

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Procedure -

1. Keep nine - differend mixture of chloroform and acid in the stoppered bottle by taking the following. (in cm³)

Chloroform -	3.0	5.0	6.0	7.0	8.0	9.0	10.0	10.0	12.0
Acetic acid	12.0	10.0	9.0	8.0	7.0	6.0	5.0	4.0	3.0

2. Keep the bofftes in the waterbath to attain the Room temprature.

3. Titrated each mixture which distilled water, adding amount. at time wich vigroum shaking until the first appearance of turbidily.

Teacher's Sign:

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for $CHCl_3$

1. Mass = 1.478 × 3.0
= 4.43 g

2. Mass = 1.478 × 5.0
= 7.39 g

3. Mass = 1.478 × 6.0
= 8.86 g

4. Mass = 1.478 × 7.0
= 10.3 g

5. Mass = 1.478 × 8.0
= 11.82 g

6. Mass = 1.478 × 9.0
= 13.30 g

7. Mass = 1.478 × 10.0
= 14.78 g

8. Mass = 1.478 × 11.0
= 16.25 g

9 Mass = 1.478 × 12.0
= 17.73 g

For CH_3COOH

1. Mass = 1.050 × 12.0
= 12.6

2. Mass = 1.050 × 10
= 10.5 g

3. Mass = 1.050 × 9.0
= 9.45 g

4. Mass = 1.050 × 8.0
= 8.4 g

5. Mass = 1.050 × 7.8
= 7.35 g

6. Mass = 1.050 × 6.0
= 6.3 g

7. Mass = 1.050 × 5
= 5.25 g

8. Mass = 1.050 × 4.0
= 4.2 g

9. Mass = 1.050 × 3
= 3.15 g.

B] Total weight of $CHCl_3$ + weight of CH_3COOH + Titrate value

1. Total weight = 4.43 + 12.6 + 6.5 = 23.53 g
2. Total weight = 7.39 + 10.5 + 5 = 22.89 g
3. Total weight = 8.86 + 9.45 + 4 = 22.31 g
4. Total weight = 10.34 + 8.4 + 3.5 = 22.24 g
5. Total weight = 11.82 + 7.35 + 3.2 = 22.37 g
6. Total weight = 13.30 + 6.3 + 2.8 = 22.4 g
7. Total weight = 14.78 + 5.25 + 25 = 22.53 g
8. Total weight = 16.25 + 4.2 + 1.5 = 21.95 g
9. Total weight = 17.73 + 3.15 + 1.2 = 22.08 g.

C] % Composition of $CHCl_3$ = $\frac{\text{wt. of. } CHCl_3}{\text{Total wt.}} \times 100$

1. % Composition of $CHCl_3$ = $\frac{4.43}{23.53} \times 100$

= 18.82 %

2. % Composition of $CHCl_3$ = $\frac{7.39}{22.89} \times 100$

= 32.28 %

(3) % Composition of $CHCl_3$ $= \frac{8.86}{22.31} \times 100$

$= 89.71\%$

4. % Composition of $CHCl_3$ $= \frac{10.34}{22.24} \times 100$

$= 46.49\%$

5. % Composition of $CHCl_3$ $= \frac{11.82}{22.37} \times 100$

$= 52.83\%$

6. % Composition of $CHCl_3$ $= \frac{13.30}{28.22} \times 100$

$= 59.37\%$

7. % Composition of $CHCl_3$ $= \frac{14.78}{22.53} \times 100$

$= 65.60\%$

8. % Composition of $CHCl_3$ $= \frac{16.25}{21.95} \times 100$

= ~~77~~ 74.08 %

9. % Composition of $CHCl_3$ $= \frac{17.73}{22.08} \times 100$

$= 80.29\%$

D] % Composition of CH_3COOH = $\frac{\text{wt of } CH_3COOH}{\text{Total wt}} \times 100$

1. % Composition of CH_3COOH = $\frac{12.6}{23.59} \times 100$

= 53.54 %

2. % Composition of CH_3COOH = $\frac{10.5}{22.89} \times 100$

= 45.87 %

3. % Composition of CH_3COOH = $\frac{9.45}{22.31} \times 100$

= 42.35 %

4. % Composition of CH_3COOH = $\frac{3.4}{22.25} \times 100$

= 37.76 %

5. % Composition of CH_3COOH = $\frac{7.35}{22.37} \times 100$

= 32.85 %

6. % Composition of CH_3COOH = $\frac{6.3}{22.4} \times 100$

= 28.12 %

7\. % Composition of CH_3COOH $= \frac{5.25}{22.53} \times 100$

$= 23.30$ %

8\. % Composition of CH_3COOH $= \frac{4.2}{21.95} \times 100$

$= 19.13$ %

9\. % Composition of CH_3COOH $= \frac{3.15}{22.08} \times 100$

$= 14.26$ %

E] % Composition of H_2O $= \frac{\text{Titrate value}}{\text{Total wt}} \times 100$

1\. % Composition of H_2O $= \frac{6.5}{23.53} \times 100 = 27.62$ %

2\. % Composition of H_2O $= \frac{5}{22.89} \times 100 = 21.84$ %

3\. % Composition of H_2O $= \frac{4}{22.31} \times 100 = 17.92$ %

4\. % Composition of H_2O $= \frac{3.5}{22.24} \times 100 = 15.78$ %

5\. % Composition of H_2O $= \frac{3.2}{22.37} \times 100 = 14.30$ %

EXPERIMENT: No.

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6. % Composition of $H_2O = \frac{2.8}{22.4} \times 100 = 12.5\%$.

7. % Composition of $H_2O = \frac{2.5}{22.53} \times 100 = 11.09\%$.

8. % Composition of $H_2O = \frac{1.5}{21.95} \times 100 = 6.83\%$.

9. % Composition of $H_2O = \frac{1.2}{22.08} \times 100 = 5.43\%$.

Result -

Three component system chloroform, water, acetic acid shows binodal curve on triangular graph The area inside The curve indicate thetrognous. system out side the indicate Homogenous. system.

Supriya
01/06/23

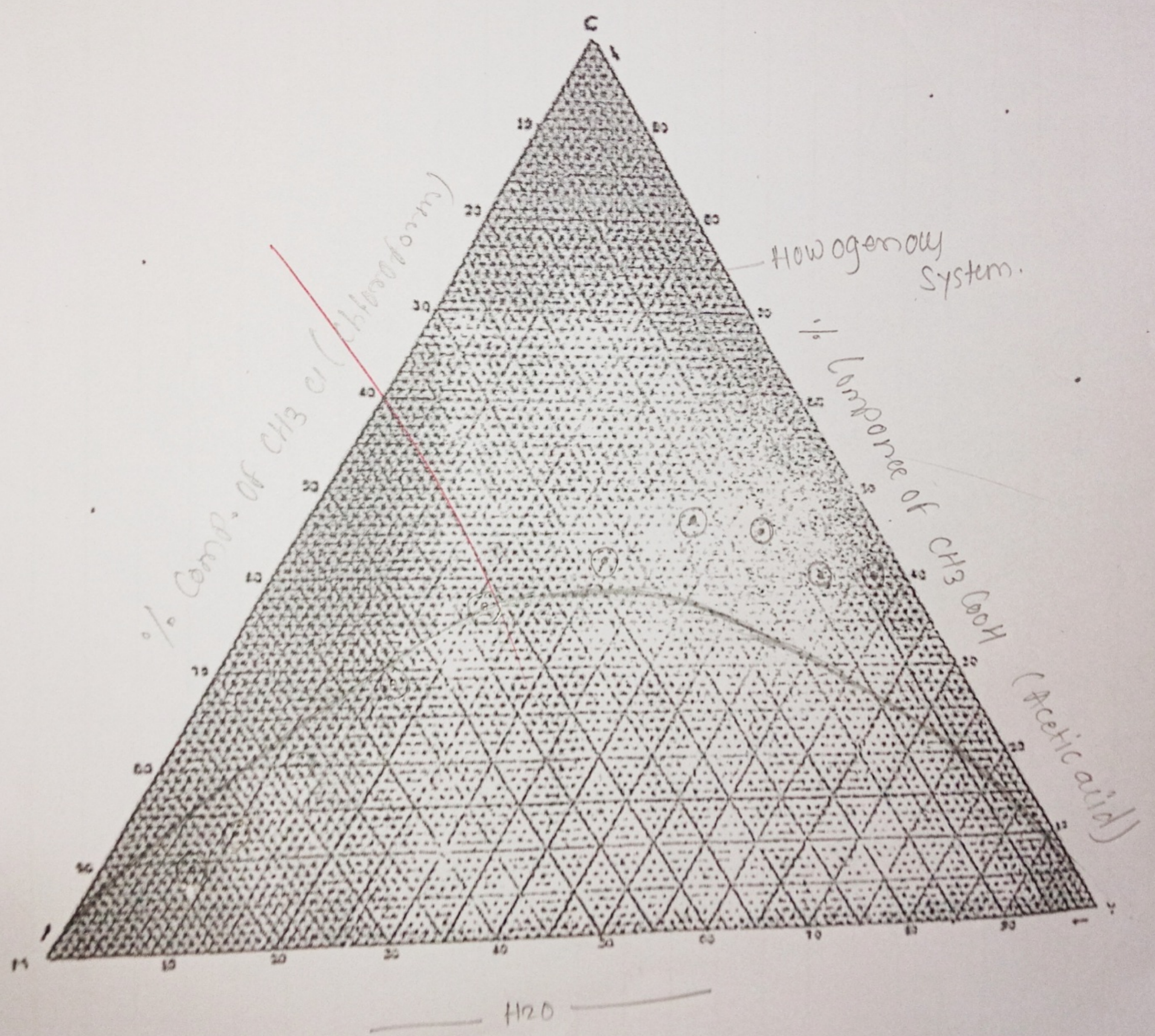
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Teacher's Sign:________

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Scale -
each onis = 1cm = 1composition.

TRIANGULAR CO-ORDINATE (20 C/H)



EXPERIMENT: No. 3 Phase diagram of water - chloroform acetic acid.

Date / / Page 15

Aim - To obtain the phase diagram for the system water chloroform acetic-acid / water - toluene - acetic acid.

Theory - on mixing water and $CHCl_3$, we get two conjugate solution of different composition. when acetic-acid is added in this system, the mutual solublity of water and $CHCl_3$ increase and a point is rached at which the mixture becomes Homogences. The quantity of acetic acid which is to added to make a homogeneous mixture depands on the Relative proparation of water and $CHCl_3$ thus of the third component in soluble in ether two component the solablity of the two Component is in Greased when the third component is added to a mixture of the other two component.

If water is added to a mixture of acetic acid $CHCl_3$ a hetrogenous mixture rantes. the quantity of water is to be added to abtain a hetrogenous mixture depend, upon the reative proparition of acetic acid. and $CHCl_3$ This of third component in sutable in only one of the other two component the solublity of component is deeased when the third components. Rs added to a mixture of the other two Components.

Requirement -

mecropipette, meerobutte. 250 cm³ glass stoppered bottes, pure, $CHCl_3$ glacial acetic acid, distilled water.

Teacher's Sign:

* **Observation** –

Solution in burette – Distilled Water.
Solution in Stoppered bottle – $CHCl_3 + CH_3COOH$
End point – colourless to turbidity

* **Observation Table** –

Weight Taken (g)		Volume Taken (cm³)		Titre value	Total weight	% Composition of final by weight		
$CHCl_3$	CH_3COOH	$CHCl_3$	CH_3COOH			$CHCl_3$	CH_3COOH	H_2O
2	18	1.35	17.14	26	46	4.3	39.1	56.5
4	16	2.70	15.23	17.4	37.4	10.6	42.7	46.5
6	14	4.05	13.33	11	31	19.3	45.1	35.4
8	12	5.41	11.42	7.9	27.9	25.6	43.0	28.3
10	10	6.76	9.52	6.2	26.2	38.1	38.1	23.6
12	8	8.11	7.61	4	24	50	33.3	16.6
14	6	9.47	5.71	2.8	22.8	61.4	26.3	12.2
16	4	10.32	3.80	1.6	21.6	74.0	18.5	7.4
18	2	12.17	1.90	1	21	85.7	9.5	4.7

Calculation –

Density of $CHCl_3$ = 1.47 g
Density of CH_3COOH = 1.050

1. $$\text{Volume} = \frac{\text{Mass (wt)}}{\text{Density}}$$

for $CHCl_3$

1. $\text{Volume} = \frac{2}{1.478}$ $= 1.359\ cm^3$

2. $\text{Volume} = \frac{4}{1.478}$ $= 2.70\ cm^3$

3. $\text{Volume} = \frac{6}{1.478}$ $= 4.05\ cm^3$

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Procedure -

1. prepare 20g of nine mixture of $CHCl_3 - CH_3COOH$ $C_6H_5CH_3 - CH_3COOH$ it contained 10, 20, 30, 40, 50, 60, 70, 80 Percent by weight of $CHCl_3 / C_6H_5CH_3$ in nine glass bottles.

2. Then ~~prepare~~ the mixture by converting the weight in accurately (density) of totune 0.88. Chlorfrom 1-478, acetic acid 1-650 g cm³)

3. Keep the bottles in water bath till it attain room temprature.

4. Titrate each mixture with distilled water, adding small amount at a time with vigeron Shaking. unit first apperance of turbdity.

Teacher's Sign:

4. volume = $\frac{8}{1.478}$ = 5.41 cm³

5. volume = $\frac{10}{1.478}$ = 6.76 cm³

6. volume = $\frac{12}{1.478}$ = 8.11

7. volume = $\frac{14}{1.478}$ = 9.47 cm³

8. volume = $\frac{16}{1.478}$ = 10.82 cm³

9. volume = $\frac{18}{1.478}$ = 12.17 cm³

for CH_3COOH.

1. Volume = $\frac{18}{1.050}$ = 17.33 cm³ (corrected: 14)

2. Volume = $\frac{16}{1.050}$ = 15.23 cm³

3. Volume = $\frac{14}{1.050}$ = 13.33 cm³

4. Volume = $\frac{12}{1.050}$ = 11.42 cm³

5. volume = $\frac{10}{1.050}$ = 9.52 cm³

6. volume = $\frac{8}{1.050}$ = 7.61 cm³

7. volume = $\frac{6}{1.050}$ = 6.71 cm³

8. volume = $\frac{4}{1.050}$ = 3.80 cm³

9. Volume = $\frac{2}{1.050}$ = 1.90 cm³

B] Total weight = weight of $CHCl_3$ + weight of CH_3COOH + Titrant

1. Total weight = 2 + 18 + 26 = 46 g
2. Total weight = 4 + 16 + 17.4 = 37.4 g
3. Total weight = 6 + 14 + 11 = 31 g

4. Total weight = 8 + 12 + 7.9 = 27.9 g
5. Total weight = 10 + 10 + 6.2 = 26.2 g
6. Total weight = 12 + 8 + 4 = 24 g
7. Total weight = 14 + 6 + 2.8 = 22.8 g
8. Total weight = 16 + 4 + 1.6 = 21.6 g
9. Total weight = 18 + 2 + 1 = 21 g

c] % Composition of $CHCl_3$ = $\frac{\text{weight of } CHCl_3}{\text{Total wt}} \times 100$

1. % Composition of $CHCl_3$ = $\frac{2}{46} \times 100$ = 4.3 %

2. % Composition of $CHCl_3$ = $\frac{4}{37.4} \times 100$ = 10.6 %

3. % Composition of $CHCl_3$ = $\frac{6}{31} \times 100$ = 19.3 %

4. % Composition of $CHCl_3$ = $\frac{8}{27.9} \times 100$ = 28.6 %

5. % Composition of $CHCl_3$ = $\frac{10}{26.2} \times 100$ = 38.1 %

~~6. %~~

6. % Composition of $CHCl_3$ = $\frac{12}{24} \times 100$ = 50 %.

7. % Composition of $CHCl_3$ = $\frac{14}{22.8} \times 100$ = 61.4 %.

8. % Composition of $CHCl_3$ = $\frac{16}{21.6} \times 100$ = 74. %.

9. % Composition of $CHCl_3$ = $\frac{18}{21} \times 100$ = 85.7 %.

D] % Composition of CH_3COOH = $\frac{\text{weight of } CH_3COOH}{\text{Total weight}} \times 100$

1. % Composition of CH_3COOH = $\frac{18}{46} \times 100$ = 39.1 %.

2. % Composition of CH_3COOH = $\frac{36}{37.4} \times 100$ = 42.7 %.

3. % Composition of CH_3COOH = $\frac{14}{31} \times 100$ = 45.1 %.

4. % Composition of CH_3COOH = $\frac{12}{27.9} \times 100$ = 43. %.

5. % Composition of CH_3COOH = $\frac{10}{26.2} \times 100$ = 38.1 %.

6. % Composition of CH_3COOH = $\frac{8}{24} \times 100$ = 33.3 %.

7. % Composition of CH_3COOH = $\frac{6}{22.8} \times 100$ = 26.3 %.

8. % Composition of CH_3COOH = $\frac{4}{21.6} \times 100$ = 18.5 %.

9. % Composition of CH_3COOH = $\frac{2}{21} \times 100$ x 9.5 %.

E] % Composition of H_2O = $\frac{\text{Titrate value}}{\text{Total volume}} \times 100$

1. % Composition of H_2O = $\frac{26}{46} \times 100$ = 56.5 %.

2. % Composition of H_2O = $\frac{17.4}{37.4} \times 100$ = 46.5 %.

3. % Composition of H_2O = $\frac{11}{31} \times 100$ = 35.4 %.

4. % Composition of H_2O = $\frac{7.9}{27.9} \times 100$ = 28.3 %.

5. % Composition of H_2O = $\frac{6.2}{26.2} \times 100$ = 23.6 %.

6. % Composition of H_2O = $\frac{4}{29} \times 100$ = 16.6 %.

7. % Composition of H_2O = $\frac{2.8}{22.8} \times 100$ = 12.2 %.

8. % Composition of H_2O = $\frac{1.6}{21.6} \times 100$ = 7.4 %.

9. % Composition of H_2O = $\frac{1}{21} \times 100$ = 4.7 %.

EXPERIMENT: No. Page 20

Result -

three component system chloroform, water and acetic acid shows binodal curve on triangular graph. The area inside the curve indicate heterogeneous system. and outside the curve indicate homogeneous system.

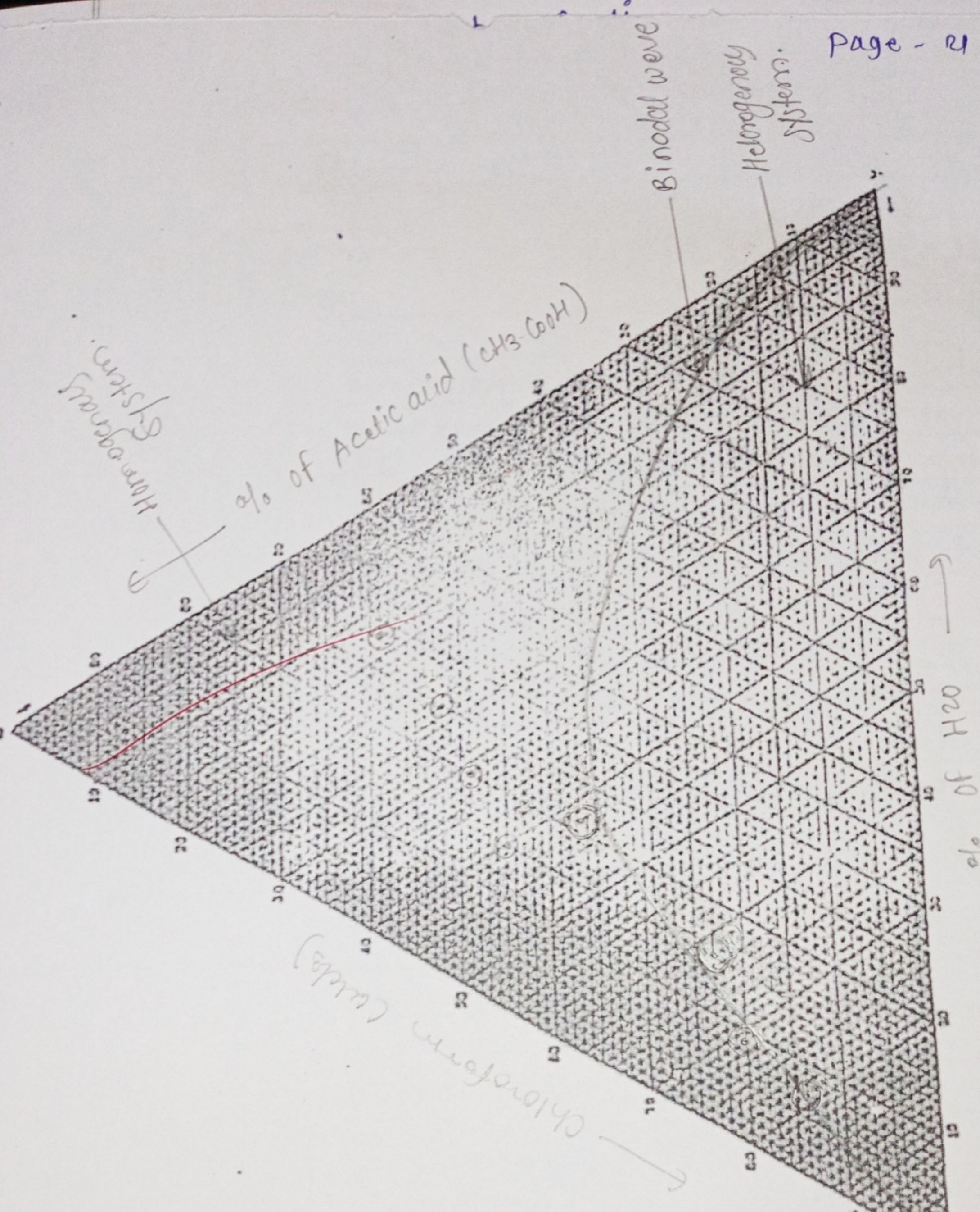
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Teacher's Sign:

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TRIANGULAR CO-ORDINATE (20 C/M)



P4-Practical-June-2019
P-119/J.Exam 126-200

EXPERIMENT: No. 4 Determination of formula of silver Ammonia complex.

Date / / Page 22

Potentiometry.

Aim - To determine the formula of silver ammonia complex potentiometeauy.

Theory - The complexation reaction involves the interaction of metal ion with ligand producing a species containing co-ordinate bond.

Let us consider that the formula for silver ammonal complex is represented as $[Ag_m(NH_3)_n]^{n}$ To decide to formula of silver-amonia complex, it is necessary to find the value of m & n.

The complex formulo can dissolve as.

$$Ag_m(NH_3)_n^{m+} \rightleftharpoons mAg^+ + nNH_3 \quad \text{--- (1)}$$

The charactestic constant, known as inability constant of complex, k can be given by.

$$K = \frac{(aAg^+)^m \times (aNH_3)^n}{(a\ complex)} \quad \text{--- (2)}$$

The activity of silver ions due to dissodeatn of the complex is given by the expression.

$$(aAg^+) = \left[\frac{K \cdot a\ Complex}{(aNH_3)^n}\right]^{1/m} \quad \text{--- (3)}$$

The expression for the potential of the silver electrode produced by dipping a silver and in with Ag tins.

Teacher's Sign:

Formula by consisad of silver ammonia complex is given by,

$$\varepsilon Ag = \varepsilon^{\circ} Ag + \frac{0.0592}{m} \log K + \frac{0.0592}{m} \log a\, complex\, (conNH_3)^n$$

In 1st set of experiment the conc. of ions is varied while the conc of ammonia is kept constant. which is sufficiently in large exess have we have.

$$(\varepsilon Ag_2 - \varepsilon Ag_1) = \frac{0.0592}{m} \log \frac{(a\, complex)_2}{(a\, complex)_1} \quad \text{—⑤}$$

The expression for the potential can be written as.

$$(\varepsilon Ag_2 - \varepsilon Ag_1) = \frac{0.0592}{m} \log \frac{(aAg^+)_2}{(aAg^+)_1} \quad \text{—⑥}$$

Substituting the values for the electrode potential obtain experimentally and the activite of Ag + taken, the value of m be obtained using eqn

5.

EXPERIMENT: No.   Date / / Page 23

formed by innisation of silver ammonia complex is given by.

$$\varepsilon Ag = \varepsilon^\circ Ag + \frac{0.0592}{M} \log k \pm \frac{0.0592}{M} \log \frac{a\ complex}{(aNH_3)^n}$$

In 1st set of experiment the conc of ions is varid white the conc. of ammonia is kept constant. which is sufficienlty in long exess. Hence we have,

$$(\varepsilon Ag_2 - \varepsilon Ag_1) = \frac{0.0592}{m} \log \frac{(a\ complex)_2}{(a\ complex)_1} \quad (5)$$

The expression for the potential can be witten as.

$$(\varepsilon Ag_2 - \varepsilon Ag_1) = \frac{0.0592}{m} \log \frac{(a\ Ag+)_2}{(a\ Ag+)_1} \quad (6)$$

Substituting the values for the electrode potenti ay abjemine experimentally and the activiltion of Ag+ taken, the value of m can be abtained using eq,

$$(\varepsilon Ag_1 - \varepsilon Ag_2) = \frac{0.0592}{m} x(n) \times \log \frac{(aNH_3)_2}{(aNH_3)_1}$$

Substituting the value of m from the 1st and liming the left potential voly from 2nd sec, the value at n can be abtained Jone 1st formula of complex.

Teacher's Sign:

EXPERIMENT: No.

Date / /
Page 24

Requirment -

0.01M $AgNO_3$ solution, 1M ammonia solution KNO_3 salt ~~St~~ saturated Colonal electrode (SCE) potentiometer measuring Flask, pipetts, beakers, etc.

procedure -

Stadardiee the potentiometer of necessary setup the following concentratⁿ call and deterune the call potential in each case.

Set - 1

	Anode compartment			Cathode compartment		
	Volume of 0.1M $AgNO_3$ solⁿ (cm³)	Volume of 1M NH_3 solⁿ (cm³)		Volume of 0.1 Ag $AgNO_3$ solⁿ (cm³)	Volume of 1M NH_3 solⁿ (cm³)	observed e.mf of cell (eu)
			Dilute each solⁿ to 100 cm³	~~5.0~~	~~10.0~~	
1.	1.0	10.0		5.0	10.0	0.016
2.	1.0	10.0		10.0	10.0	0.030
3.	1.0	10.0		10.0	10.0	0.040

Teacher's Sign:

Calculation

Set - I

	E Cell in V	Effective conc. of $AgNO_3$ in anodic half cell (x_1)	Eff. conc. of $AgNO_3$ in cathodic half cell (x_2)	x_2/x_1	$\log(x_2/x_1)$	$m = \frac{0.05916 \log(x_2/x_1)}{E cell}$
1.	0.016	1×10^{-4}	5×10^{-4}	5	0.6989	2.58
2.	0.080	1×10^{-4}	7.5×10^{-4}	7.5	0.8750	1.75
3.	0.040	1×10^{-4}	10×10^{-4}	10	1	1.47

Mean - 1.92

Set = II

	E Cell in v	Eff. conc. of NH_3 in anodic half cell (1)	eff. con. c of NH_3 in cathodic half cell (2)	c_1/c_2	$\log(c_1/c_2)$	$n/m = E cell / 0.05916 \log[c_1/c_2]$
1.	0.085	0.25	0.1	2.5	0.3979	0.5716
2.	0.080	0.20	0.1	2	0.3010	0.4070
3.	0.070	0.15	0.1	1.5	0.1760	0.2082

EXPERIMENT: No.

Date / /
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Set - III

	Anode compartment -			Cathode compartment.		
	Vol. of 0.01 aq $AgNO_3$ soln (cm^3)	Volume of 1M NH_3 solution (cm^3)		Volume of 0.01M $AgNO_3$ soln (cm^3)	Volume of aq NH_3 soln (cm^3)	observed emf of cell (V)
1.	1.0	25.0	Dilute each soln of 100 cm^3	1.0	10.0	0.085
2.	1.0	20.0		1.0	10.0	0.080
3.	1.0	15.0		1.0	10.0	0.070

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Teacher's Sign:

	m	n/m	n = (m) α (n/m)
1.	2.58	0.5716	1.474
2.	1.72	0.4070	0.700
3.	1.47	0.2082	0.306
	Mean = m = 1.92	Mean = n/m = 0.395	mean = 0.026

for set - I

Effective conc. of $AgNO_3$ in anodic half cell (x_1) is,

$$M_1V_1 = M_2V_2$$

$$0.01 \times 1.0 = M_2 \times 100$$

$$\therefore M_2 = \frac{0.01 \times 1.0}{100}$$

$$\therefore M_2 = 1 \times 10^{-4} M$$

Effective conc. of $AgNO_3$ in cathodic half cell (x_2)

$$M_1V_1 = M_2V_2$$

① $0.01 \times 5.6 = M_2 \times 100$

$$\therefore M_2 = \frac{0.01 \times 5.0}{100}$$

$$\therefore M_2 = 5 \times 10^{-4} M$$

2. $10.01 \times 7.5 = M_2 \times 100$

$$M_2 = \frac{0.01 \times 7.5}{100}$$

$$\therefore M_2 = 7.5 \times 10^{-4} M$$

3. $0.01 \times 100 = M_2 \times 100$

$$M_2 = \frac{0.01 \times 10.0}{100}$$

$$M_2 = 1 \times 10^{-3}$$

$$\therefore M_2 = 10 \times 10^{-4} M$$

x_2 / x_1

1. $(5 \times 10^{-4}) \div (1 \times 10^{-4}) = 5$

2. $(7.5 \times 10^{-4}) \div (1 \times 10^{-4}) = 7.5$

3. $(10 \times 10^{-4}) \div (1 \times 10^{-4}) = 10$

$\log (x_2/x_1)$

1. $\log (5) = 0.6989$

2. $\log (7.5) = 0.8750$

3. $\log (10) = 1$

$$m = \frac{0.05916 \times \log [x_2/x_1]}{E_{cell}}$$

1. $m = \frac{0.05916 \times (0.6989)}{0.016}$

$\therefore m = 2.58$

2. $m = \frac{0.05916 \times (0.8750)}{0.030}$

$\therefore m = 1.72.$

3. $m = \frac{0.05916 \times (1)}{0.040}$

$= 1.47$

Set = II.

effective conc. of NH_3 in anodic half cell (c_1) is,

$$C_1V_1 = C_2V_2$$

1. $C_1 \times 100 = 1 \times 25.0$

$\therefore C_1 = \frac{1 \times 25.0}{100}$

$C_1 = 0.25$

2. $C_1 \times 100 = 1 \times 20.0$

$\therefore C_1 = \frac{1 \times 20.0}{100}$

$\therefore C_1 = 0.20$

3. $C_1 \times 100 = 1 \times 15.0$

$\therefore C_1 = \frac{1 \times 15.0}{100}$

$\therefore C_1 = 0.15$

Effective conc. of NH_3 in cathodic half cell (c_2) is,

$$C_1V_1 = C_2V_2$$

$1 \times 10.0 = C_2 \times 100$

$\therefore C_2 = \frac{1 \times 100}{100}$

$\therefore C_2 = 0.1$

C_2 / C_1

1. $(0.25) \div (0.1) = 2.5$

2. $(0.20) \div (0.1) = 2$

3. $(0.15) \div (0.1) = 1.5$

$\log(c_1/c_2)$

1. $\log(2.5) = 0.3979$

2. $\log(2) = 0.3010$

3. $\log(1.5) = 0.1760$

$$n/m = E_{cell} / 0.05916 \times \log(c_1/c_2)$$

1. $$n/m = \frac{0.085}{0.05916 \times (0.3979)} = 0.5716.$$

2. $$n/m = \frac{0.080}{0.05916 \times (0.3010)} = 0.4070$$

3. $$n/m = \frac{0.070}{0.05916 \times (0.1760)} = 0.2082$$

Result -

The emperical formula of complex is

$(mAg + nNH_3) = [Ag_m \ (NH_3)_n]$

$1 Ag + 2 NH_3 = [Ag_1 \ [NH_3]_2]^+$

Supriya
01/06/23

EXPERIMENT: No. 5 Determination of Hammette constant of m and P amina / nitro benzonic and by PH measurement   Date / /   Page 30

Conductometry

Aim - To determine orbital mi cell concentration CMC To Solution lauryl sulphate from measurement of Conductivities of aqueous solution of diffrent concentration.

Theory -

Surfatouts are the substance which get adsarbed at an interface and they after the surface tensⁿ The aq. solution of such substances are colloidal in nature with increase in concentratⁿ above which ther mi cally become detechable is called as molecules. in such as aggregate is vreally which the Range of 50-100 but at can reach ~~ever~~ upto 1000.

When mi celld are farmula most of the propertial of a surtacet out solution of Infinidual molaculation this mobility is lower then that of corresponding single molecules - The change in electrical conduance of agrean ions sufuctant solution at the CMC is as a ~~##~~ Strong electroluyle while above CMC, if behave as partially ionised system. Hence in the surging of low. conanhatⁿ unductitory fnesses shartly while after. solution CMC. If renary, almost constant. CMC can earity be determine other any point of two line

* Observation Table -

Concentration (C)	Conductance	Sp. conductance	λ_m	$\sqrt{c}$
1×10^{-3}	0.89×10^{-3}	0.90×10^{-4}	0.96	0.1
2×10^{-3}	0.85×10^{-3}	0.91×10^{-4}	1.01	0.09
3×10^{-3}	0.80×10^{-3}	0.86×10^{-4}	1.07	0.08
4×10^{-3}	0.74×10^{-3}	0.79×10^{-4}	1.12	0.07
5×10^{-3}	0.65×10^{-3}	0.70×10^{-4}	1.16	0.06
6×10^{-3}	0.61×10^{-3}	0.65×10^{-4}	1.30	0.05
7×10^{-3}	0.52×10^{-3}	0.56×10^{-4}	1.40	0.04
8×10^{-3}	0.49×10^{-3}	0.48×10^{-4}	1.60	0.03
9×10^{-3}	0.33×10^{-3}	0.35×10^{-4}	1.75	0.02
10×10^{-3}	0.24×10^{-3}	0.25×10^{-4}	2.50	0.01
11×10^{-3}	0.23×10^{-3}	0.24×10^{-4}	3.0	0.021
12×10^{-3}	0.20×10^{-3}	0.21×10^{-4}	4.20	0.022

* Calculation -

A) Conductance (S) =

$M_1V_1 = M_2V_2$ where, $M_1 = 0.02$ & $V_2 = 50$ constant.

$\therefore V_1 = \frac{M_2V_2}{M_1}$

1. $V_1 = \frac{1\times10^{-2} \times 50}{0.02} = 25$ ml

3. $V_1 = \frac{8\times10^{-3} \times 50}{0.02} = 20$ ml

2. $V_1 = \frac{9\times10^{-3} \times 50}{0.02} = 22.5$ ml

4. $V_1 = \frac{7\times10^{-3} \times 50}{0.02} = 17.5$ ml

EXPERIMENT: No.

Date / /
Page 81

Requirement -

Conductivity meter, conductance cell, conductivity water 0.02M solution of sodium lauryl sulphate 10.1M potassium chloride solution.

Procedure -

1. Standardize the conductivity meter.
2. Determine the cell constant of given conductance of cell using supplied 0.1 M kcl solution.
3. from the given 0.02M solution of sodium lauryl soln prepare 1×10^{-2}, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0.8 & 5×10^{-3} m solution by dilute with conductivity water and determine the conductance of each solution.

Given - specific conductance of 0.1M KCl soln at 32°C

$= 0.1362 \ S\ cm^{-1}$

Tabulate your observations as following.

$$\text{Cell constant} = \frac{\text{Specific conductance of 0.1M kcl}}{\text{observance conductance of 0.1 M KCl}}$$

$$= \frac{0.01362}{12.61 \times 10^{-3}}$$

$= -1.08\ m/cm^3$

Teacher's Sign:

5. $V_1 = \frac{6 \times 10^{-3} \times 50}{0.02} = 15.0\,ml$

6. $V_1 = \frac{5 \times 10^{-3} \times 50}{0.02} = 12.5\,ml$

7. $V_1 = \frac{4 \times 10^{-3} \times 50}{0.02} = 10.0\,ml$

8. $V_1 = \frac{3 \times 10^{-3} \times 50}{0.02} = 7.5\,ml$

9. $V_1 = \frac{2 \times 10^{-3} \times 50}{0.02} = 5.0\,ml$

10) $V_1 = \frac{1 \times 10^{-3} \times 50}{0.02} = 2.5\,ml$

11. $V_1 = \frac{08 \times 10^{-3} \times 50}{0.02} = 2.0\,ml$

12. $V_1 = \frac{0.5 \times 10^{-3} \times 50}{0.02} = 1.25\,ml$

e] Specific conductance = Cell constant × obs. Conductance.

1. SP Cond $= 1.08 \times (0.89 \times 10^{-3})$
$= 0.96 \times 10^{-4}$

2. SP cond $= 1.08 \times (0.85 \times 10^{-3})$
$= 0.91 \times 10^{-4}$

3. SP Cond $= 1.08 \times (0.80 \times 10^{-3})$
$= 0.86 \times 10^{-4}$

4. SP Cond $= 1.08 \times (0.74 \times 10^{-3})$
$= 0.79 \times 10^{-4}$

5. SP Cond $= 1.08 \times (0.61 \times 10^{-3})$
$= 0.70 \times 10^{-4}$

6. SP Cond $= 1.08 \times (0.61 \times 10^{-3})$
$= 0.65 \times 10^{-4}$

7. SP Cond $= 1.08 \times (0.45 \times 10^{-3})$
$= 0.48 \times 10^{-4}$

8. SP cond $= 1.08 \times (0.45 \times 10^{-3})$
$= 0.48 \times 10^{-4}$

9. SP Cond. $= 1.08 \times (0.33 \times 10^{-3})$
$= 0.35 \times 10^{-4}$

10. SP Cond $= 1.08 \times (0.24 \times 10^{-3})$
$= 0.25 \times 10^{-4}$

11. SP Cond $= 1.08 \times (0.23 \times 10^{-3})$
$= 0.24 \times 10^{-4}$

12. SP Cond $= 1.08 \times (0.20 \times 10^{-3})$
$= 0.21 \times 10^{-4}$

9] $\lambda m = \frac{1000 \times K}{C}$

1. $\lambda m = \frac{1000 \times (0.96 \times 10^{-4})}{1 \times 10^{-2}}$

$= 0.96$

2. $\lambda m = \frac{1000 \times (0.91 \times 10^{-4})}{9 \times 10^{-3}}$

$= 1.01$

3. $\lambda m = \frac{1000 \times (0.86 \times 10^{-4})}{8 \times 10^{-3}}$

$= 1.07$

4. $\lambda m = \frac{1000 \times (0.70 \times 10^{-4})}{7 \times 10^{-3}}$

$= 1.12$

5. $\lambda m = \frac{1000 \times (0.70 \times 10^{-4})}{6 \times 10^{-3}}$

$= 1.16$

6. $\lambda m = \frac{1000 \times (0.65 \times 10^{-4})}{5 \times 10^{-3}}$

$= 1.30$

7. $\lambda m = \frac{1000 \times (0.36 \times 10^{-4})}{4 \times 10^{-3}}$

$= 1.40$

8. $\lambda m = \frac{1000 \times (0.48 \times 10^{-4})}{3 \times 10^{-3}}$

$= 1.60$

9. $\lambda m = \frac{1000 \times (0.35 \times 10^{-4})}{2 \times 10^{-3}}$

$= 1.75$

10. $\lambda m = \frac{1000 \times (0.25 \times 10^{-4})}{1 \times 10^{-3}}$

$= 2.50$

11. $\lambda m = \frac{1000 \times (0.24 \times 10^{-4})}{0.8 \times 10^{-3}}$

$= 3.0$

12. $\lambda m = \frac{1000 \times (0.21 \times 10^{-4})}{0.5 \times 10^{-3}}$

$= 4.20$

4] $\sqrt{c}$

1. $\sqrt{1\times10^{-2}}$ = 0.1

2. $\sqrt{9\times10^{-3}}$ = 0.9

3. $\sqrt{8\times10^{-3}}$ = 0.8

4. $\sqrt{7\times10^{-3}}$ = 0.7

5. $\sqrt{6\times10^{-3}}$ = 0.6

6. $\sqrt{5\times10^{-3}}$ = 0.5

7. $\sqrt{4\times10^{-3}}$ = 0.4

8. $\sqrt{3\times10^{-3}}$ = 0.3

9. $\sqrt{2\times10^{-3}}$ = 0.2

10. $\sqrt{1\times10^{-3}}$ = 0.1

11. $\sqrt{0.8\times10^{-3}}$ = 0.028

12. $\sqrt{0.8\times10^{-3}}$ = 0.022

Critical mi cell concentration (cmc) = 2.0+1.6
= 3.6

Result -

CMC of solution lauryl Sulphide is 3.6

Supriya
01/06/23

x - axis 1cm = 0.01 cm³
Y - axis 1cm = 0.5 cm³

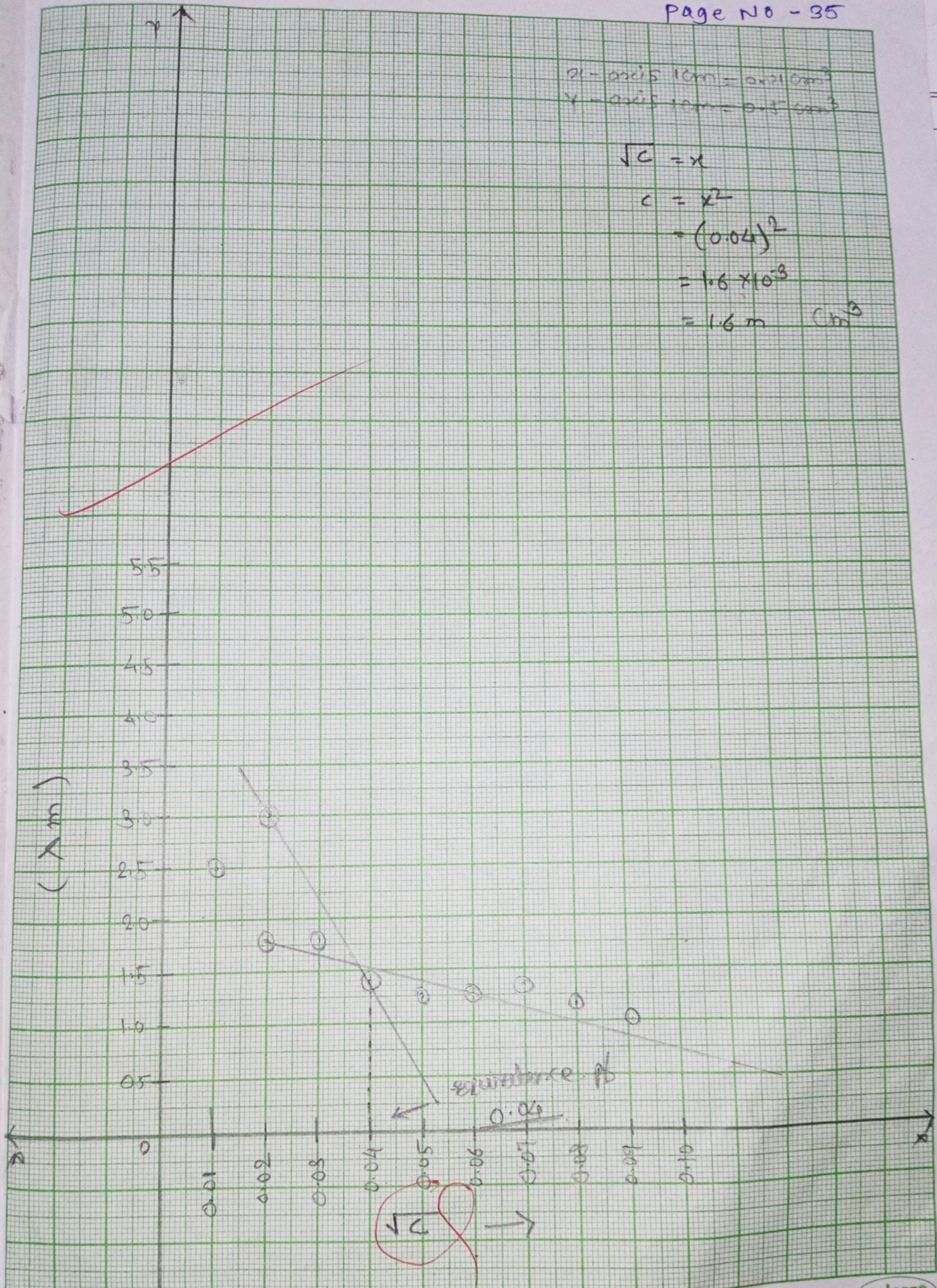
$\sqrt{c} = x$

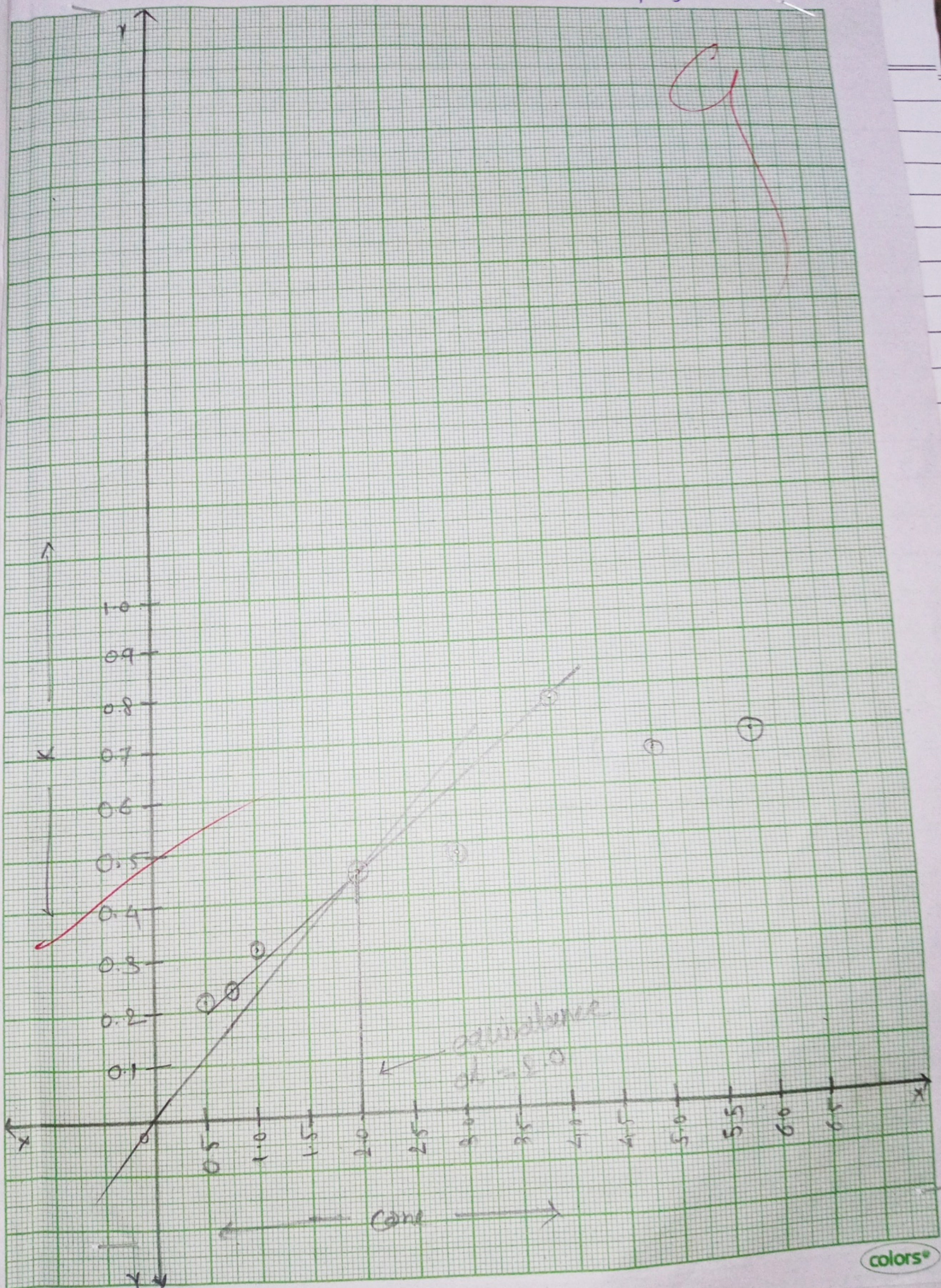
$c = x^2$

$= (0.04)^2$

$= 1.6 \times 10^{-3}$

$= 1.6$ m cm³




Y
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
X
conc

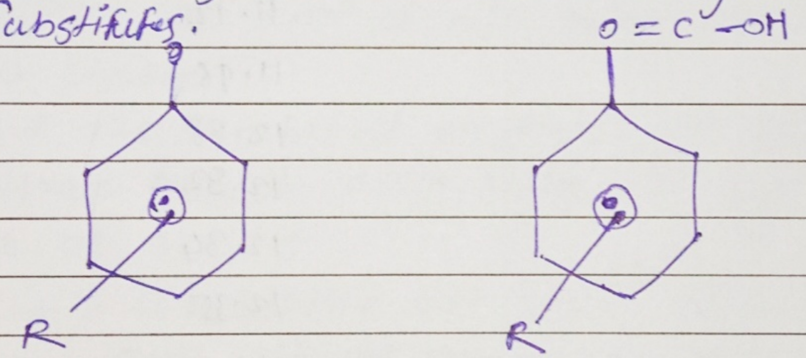
EXPERIMENT : NO 6 PH - Metry

Aim -

To determine Hamatte constant of m and p-aminol Nitro benzoic acid by PH measurment.

Theory -

The effect of substitant at meta and para position of aromatic acidic ay on the rate of reaction or equilibrium constant can be studied using Hammettres reule. It staten that the logarith ms of the rate constant of the reaction prosesing in side chain iv of compounds of type a. or the logaribm of equilibrium. Constant of reaction. affective the graph Y Y are lineonly reaction to the lo reaction constant of the show possing benzoic acids having the same substitutes.



According to this rule, the equilibriam constant of the substitued compound is reluated to the equilibriam. Constant of the unsubstituted compound. along with two constant 6 & δ

$$\log k = \log k^{\circ} + 6 * \delta$$

or $pk^{\circ} - pk = 6 * \delta$

where. 6 & δ are constant. The constant 6 is known as substitunt constant since its value.

* Observation Table -

p - amino benzoic acid.

volume of 0.2 M NaOH solution (cm^3)	pH.
0.0	4.88
0.5	5.52
1.0	5.57
1.5	5.80
2.0	5.94.
2.5	6.52
3.0	6.88
3.5	7.27
4.0	10.25
4.5	11.12
5.0	11.96
5.5	12.28
6.0	12.32
6.5	12.34
7.0	12.35

$$pK_1 = pH \text{ at } \left[\frac{4.0}{2.0}\right]$$

$$= \frac{4.0}{2.0}$$

pH at (2.0).

$$\therefore pK_1 = 5.9$$

Rajdhani
DATE / /

depend only on Substituent while the constant of is known as reaction and its value mainly depends upon the solvent employed.

Requirements -

PH meter, glass and calomel electrod or burettes. 0.00M m/P nitrobenzoic acid, 0.00M m/P amino benzoic acid, 50% alcohol water. mix 0.01 NaOH Soln, buffer Soln, PH = 4.0, 002M NaOH PH - 9.2

Procedure -

1. Standardize the PH meter using the buffer soln of PH = 4.0 & PH = 9.2
2. pipette out 50cm³ of m/P amino benzoic acid in a beaker.
3. Dip the combined electrode in this soln and titrate against 0.2M NaOH soln by adding 0.5 cm cut. at a time.
4. Similarity pipette out 50 cm³ of m/P nitrobenzonic acid soln titrate against 0.2 M NaOH

* Calculation –

p- amino benzoic acid

$pK_1 = pH$ at $\left[\frac{V_1}{2.0}\right]$

$= \frac{4.0}{2.0}$

pH at (2.0)

pK_1 5.9

Hammette constant σ for p-amino benzoic acid

$\frac{pK^\circ - pK^1}{\sigma} = \rho$

$\therefore \sigma = \frac{pK^\circ - pK^1}{\rho}$

$= \frac{4.21 - 5.9}{1.65}$

$\therefore \sigma = 0.63$

p- nitro benzoic acid

$pK^2 = pH$ at $\left[\frac{V_2}{2.0}\right]$

$= \frac{4.5}{2.0}$

pK_1 at (2.25)

$pK_2 = 3.9$

Hammate constant σ for p-nitro benzoic acid

$$\frac{pK^{\circ} - pK^{2}}{\sigma} = \rho$$

$$\therefore \sigma = \frac{pK^{\circ} - pK^{2}}{\rho}$$

$$= \frac{4.21 - 3.9}{1.65}$$

$$\therefore \sigma = 1.84$$

1
2
3
4
5

Rajdhani
DATE / /

Result -

1. pK° for benzoic acid = 4.21

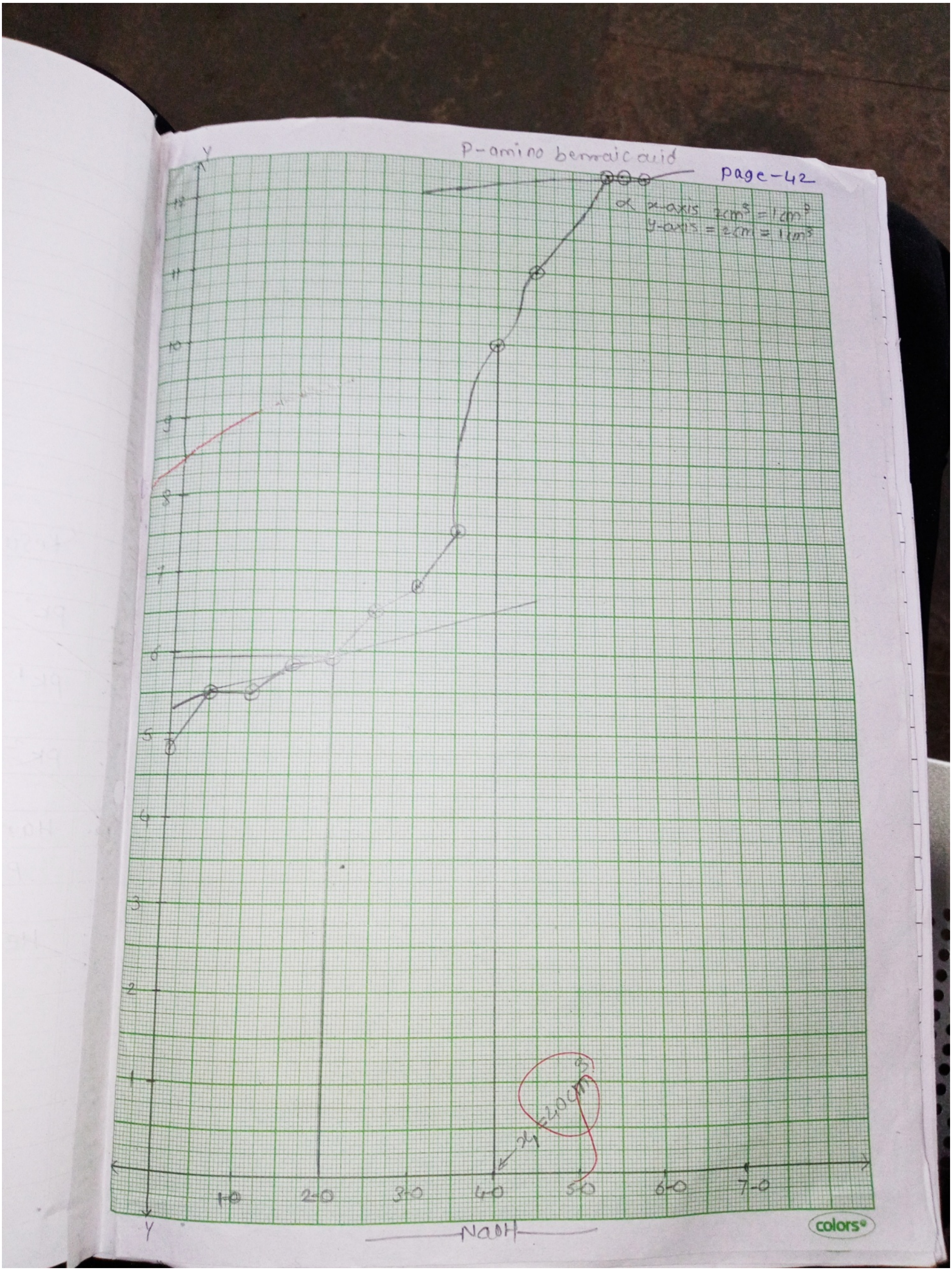
2. pK^{1} for p-amino benzoic acid = 5.9

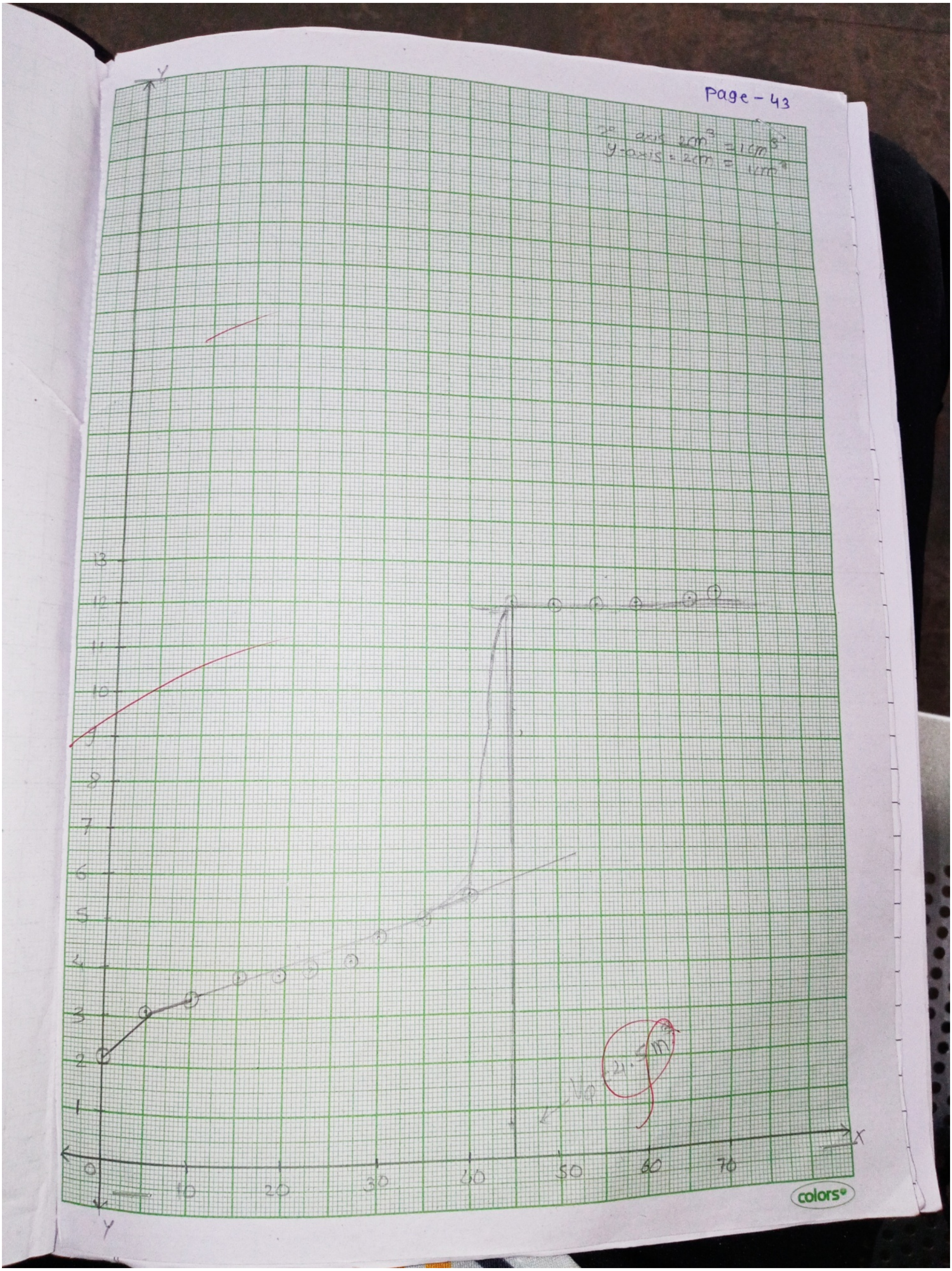
3. pK^{2} for p-nitro benzoic acid = 3.9

4. Hammette constant σ for p-amino benzoic acid = 0.63

5. Hemmette constant σ for p-nitro benzoic acid. = 1.84

Supriya


P-amino benzoic acid
page-42
x-axis 2cm = 1cm³
y-axis = 2cm = 1cm³
Y
12
11
10
9
8
7
6
5
4
3
2
1
1·0
2·0
3·0
4·0
5·0
6·0
7·0
x₁ = 40cm³
NaOH
colors


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Y
X
0
10
20
30
40
50
60
70
1
2
3
4
5
6
7
8
9
10
11
12
13
Vp
colors